

Triops granarius (Lucas) (Crustacea: Branchiopoda) from Tamil Nadu, and a Review of the Species from India

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(With two text-figures)

INTRODUCTION

Specimens of the Notostracan genus *Triops* Schrank (*Apus* Schaeffer), have been reported from time to time, from isolated localities in India and have been described under different specific names. This genus is notorious for its intraspecific morphological variations so that some times, the same species from a different locality, or juveniles of the same species, have been described under different specific names, adding to the taxonomic confusion within the genus.

Packard (1871) was the first to record from India, two specimens of *Triops* (*Apus*) from a stagnant pool on the Himalayas and assigned them to the species *himalayanus*. Walton (1911) subsequently reported *Triops* (*Apus*) from Bulandshahr District, United Provinces and indicated their resemblance to *Triops* (*Apus*) *cancriformis* (Bosc). Kemp (1911) surveying the records of *Triops* (*Apus*) in eastern Asia, pointed out that Major Walton's specimens from the United Provinces and his own from Kashmir were identical with *Triops* (*Apus*) *cancriformis* (Bosc) and indicated that Packard's *Triops* (*Apus*) *himalayanus* is perhaps not distinct from *Triops* (*Apus*) *cancriformis* (Bosc), with which view Gurney (1925) agreed. Besides reporting *Triops* (*Apus*) *cancriformis* (Bosc) from Kashmir, Gurney (1925) described *Triops* (*Apus*) *asiaticus* from Panchgani in Bombay State. *Triops* (*Apus*) *asiaticus* was only a *nomen novo* reluctantly introduced by Gurney (1921) for specimens of *Triops* (*Apus*) *granarius* from Baghdad. Since these and similar ones from the Chingham Mountains in Central Asia described by Sars (1901) were thought to be different from *Triops* (*Apus*) *granarius* (Lucas) from Africa, Gurney

resorted to this new specific name. Tiwari (1951) in turn, considering the Panchgani forms to be not identical with the Central Asian forms of *Triops (Apus) asiaticus* of Gurney, described the Panchgani forms as *Triops (Apus) orientalis* and the juvenile forms of the same species from Mavli in Rajasthan, as *Triops (Apus) mavliensis*. Longhurst (1955), however, in his exhaustive revision of the genus, synonymised *Triops (Apus) orientalis* and *Triops (Apus) mavliensis* with *Triops (Apus) granarius* (Lucas). Shanbhag & Inamdar (1968) basing on collections from Port Okha (Gujarat), maintain that *Triops (Apus) mavliensis* (Tiwari) is a valid species, but I feel that the armature of the telson falls within the range of intraspecific variations described by Longhurst (loc. cit.) for *Triops granarius* (Lucas).

Longhurst (loc. cit.) in his revision of the genera and species of Notostraca, remarks graphically, 'Individual Notostraca are notoriously variable and differences in the armature of spines on the exoskeleton, or in the body proportions can be found in any pair of animals, even those from the same pool. This together with the lack of morphological discontinuities within the genera, makes the group a 'difficult' one systematically, and has resulted in the excessive number of descriptions of specimens rather than species, with which the synonymies are now burdened.' Accordingly, he reduced nearly 45 'species' of the genus *Triops (Apus)* described in literature to just four species, providing exhaustive synonymies for each of the valid species and a key for the identification of the species. He indicated that these four valid species seem to conform to four major geographic areas of distribution, with tendencies for sub-speciation and racial differences within each.

According to this revision, only two species, *T. cancriformis* (Bosc) and *T. granarius* (Lucas) occur within the limits of India, the former in northern localities like the Himalayas, Kashmir, United Provinces and Gujarat and the latter in the rest of India from Panchgani in Maharashtra State to the southernmost part of India.

Subsequently, Tiwari (1955) provided additional information on the sex-ratio and apodous segments, Pai (1958) described the post-embryonic stages, and Karande & Inamdar (1959) analysed the taxonomic characters of *Triops (Apus) granarius* from Panchgani.

Chacko (1950) reported on the occurrence of a single male of *Triops (Apus) sudanicus* Brauer from Nagasunni Temple Tank in the Tirunelveli District of the Madras State and Tiwari (1951) described it in detail under the same specific name. Longhurst (loc. cit.) however, has not considered it in his revision, perhaps owing to lack of material. Since the present collection of a large number of males and females are from the same district and since the descriptions of Chacko (loc. cit.) and Tiwari (1951) agree with the present material, with due allowances for intraspecific variations, it is believed that *Triops (Apus) sudanicus* of

Chacko and Tiwari are synonyms of *Triops (Apus) granarius* (Lucas), under the present study.

The following taxonomic analysis of *T. granarius* (Lucas) collected from the Tirunelveli District in Madras State and the comparison of these specimens with earlier records of this species from India, are all based on Longhurst's (loc. cit.) revision.

During October-November 1965, hundreds of specimens of *Triops* from rain water ponds and tanks in villages like Rajagopalpuram and Perumalpuram around Palayamkottai, in the Tirunelveli District were collected by Prof. M. H. Martin of St. John's College, Palayamkottai. Nearly thirty of them preserved in formalin were sent to me together with notes on live specimens. Some got accidentally dried up in one vial but fourteen in the other vials are left in good condition for study. These specimens were said to occur commonly at other places like Srivaikuntam in the same district.

SYNONYMY FOR INDIAN RECORDS OF *Triops granarius* (LUCAS)

- 1864. *Apus granarius* Lucas.
- 1921. *Apus asiaticus* (nom. nov.) for *Apus granarius* (Sars) Gurney.
- 1924. *Apus asiaticus* Gurney.
- 1925. *Apus asiaticus* Gurney.
- 1950. *Apus sudanicus* Chacko.
- 1951. *Apus orientalis* Tiwari.
- 1951. *Apus mavliensis* Tiwari.
- 1951. *Apus sudanicus* Tiwari.
- 1955. *Apus orientalis* Tiwari.
- 1955. *Triops granarius* Longhurst.
- 1958. *Triops (Apus) granarius* Pai.
- 1959. *Triops orientalis* Karande and Inamdar.
- 1968. *Triops mavliensis* Shanbhag and Inamdar.

TAXONOMIC ANALYSIS

The six male and the eight female specimens in this collection are mature individuals with eggs in the brood pouches of the females.

Carapace : Since the total length of specimens or the length of abdomen are so variable, depending on growth differences so common in the genus *Triops*, and also dependent on the degree of contraction of the abdominal segments, measurements of carapace and its parts alone are given here, because Longhurst (loc. cit.) mentions that the growth of carapace is isometric and is therefore, a valid measurement of size at all stages.

As evident from the dimensions of the carapace, females are larger than males in this collection. Carapace is oval and about $1/6$ longer

MEASUREMENTS FOR 14 SPECIMENS (SIX MALES AND EIGHT FEMALES) IN MM.

	♂♂		♀♀	
	Range	Mean	Range	Mean
Length of carapace (median)	.. 18-20	18.6	18-24	20.6
Width of carapace	.. 14-16	15.2	15-18	16.4
Length of carina	.. 10-12	10.5	10-13	11.6
Length of fifth endite of first thoracic leg	.. 16-20	18.9	15-24	19.2
Width of sulcus	.. 5-7	5.2	6-7	6.7
Depth of sulcus	.. 3-4	3.9	4-5	4.3

than breadth (Fig. 1). Carina is a little over $\frac{1}{2}$ the length of carapace, along its median line. Carina is in the form of a single ridge bearing a few spines towards its hinder end nearer the sulcus. There is no prominent terminal spine. Sulcus is deeply oval, about $1/3$ the breadth of carapace and about $2/3$ as deep as broad. It bears about 43-54 sulcal spines on its free edge.

Posterior angles of carapace are not drawn out nor its lateral margin concave at angles. Edge of carapace is finely serrated towards hinder end and the serration may take the form of minute spines at the hindermost part. Carapace bears fine denticles here and there on its dorsal surface, particularly at its posterior region.

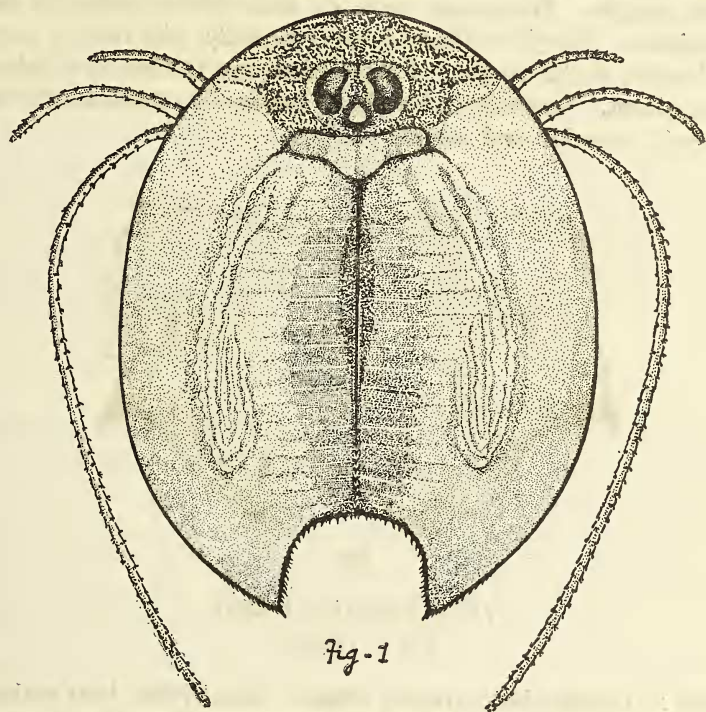
Dorsal organ triangular and is clearly elevated rather than depressed. Fifth endite of the first pair of thoracic legs is certainly as long as carapace length, and it may extend slightly beyond the hind end of carapace.

Coloration : Their coloration in live condition according to Prof. Martin who collected them was, 'Carapace translucent greyish-brown dorsally and orange-red ventrally. Abdomen and appendages also are orange-red.' This agrees with the known fact that specimens from poorly aerated waters have more haemoglobin intensity, giving deep orange-red colour. Sexual differences in coloration are not quite evident in this collection.

In the preservative formalin, carapace is translucent-grey along its lateral edges but opaque olive-green medially. Eyes dark-grey. Mandibles and other chitinous parts anterior to them are dark-brown. Appendages are colourless. Abdomen is light-brown and furca dark-brown.

Abdomen : Abdomen varies in length in the preserved material but on the average, it is slightly less than $\frac{1}{2}$ but decidedly over $1/3$ of the total length of the body. Total number of movable somites in the body is about 33-35 in females and 34-37 in males, of which 13-20 in females and

15-25 in males are exposed behind the carapace. Number of apodous segments is on the average, about 6 for females and 9 for males (Table *vide infra*). Each abdominal segment has 7-11 spines dorsally and



Triops granarius (Lucas)

Fig. 1. Carapace

about the same number ventrally also, but the ventral spines are smaller. Usually, spines are more in anterior abdominal segments, so that posterior abdominal segments may have just 6-8 spines dorsally. Last abdominal segment in some cases, may be seen on one side alone, either dorsally or ventrally.

FREQUENCY OF APODOUS SEGMENTS IN SIX MALES AND EIGHT FEMALES

	No. of segments	No. of individuals	Average No. of segments
♂♂	8	1	6
	9	3	
	10	2	
♀♀	5	2	8
	6	3	
	7	2	
	8	1	

Telson : Broader than the last abdominal segment (Fig. 2). - Emarginate and bears two to four median spines in a row and three to four very large posterior marginals in a transverse row, well forward of the posterior margin. Three setal spines on each side but setae not seen in any specimen. Margin of telson is spiny laterally, with four to six more spines interior to the margin. Furcal spines two to three in number are very prominent. Ventrally, telson bears numerous small denticles along the lateral, posterior and median regions.

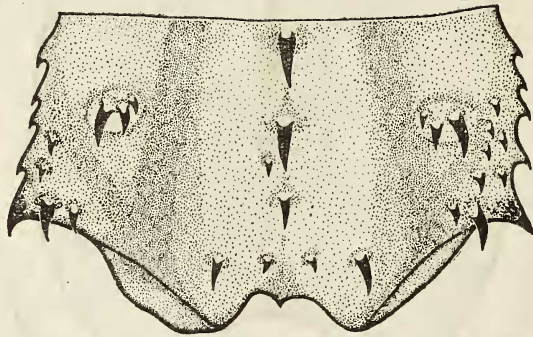


fig - 2

Triops granarius (Lucas)

Fig. 2. Telson

Furca : Longer than carapace length. Basal joints bear scales and bristles but distal joints bear bristles alone.

A male and a female of these specimens have been incorporated in the National Zoological Collections with the Registration No. C 4791/1.

OBSERVATIONS ON LIVE ANIMALS

The following notes on live specimens, is compiled from information kindly provided by Prof. M. H. Martin who has collected and kept these animals alive in his laboratory for some days.

Triops granarius is noted to occur in temporary ponds alone, just after the first rains of the northeast monsoon, obviously hatching out of the resistant dormant eggs, deposited in the mud prior to the drought season. They are abundant, just for a short time and dwindle down fast in numbers, so that by the end of November, practically none of them can be seen in the ponds.

They swim on their backs as the Common Fairy Shrimp, *Streptocephalus*, perhaps feeding about and they can occasionally swim in normal posture also. In the laboratory, specimens of *Triops granarius* were kept

alive for two or three days when they were found to feed on *Streptocephalus*, which seems to be their chief food and occasionally, they seem to feed on dead ones of their own kind also. During the day time, they seem to congregate in deeper ditches of the ponds, where *Streptocephalus* abounds. Quite often in the laboratory, they were found to chase each other. Whether this is a courting habit or a cannibalistic habit, is not certain. However, *Triops granarius* is described by Karande & Inamdar (1959) to have cannibalistic tendencies.

In the aquarium, when they touch the bottom as they swim about, they turn on to their belly and can crawl fast on the floor, by their appendages. Egg-laying was noticed in the aquarium when they dig the bottom mud with their appendages, deposit eggs and cover them up with loose mud, with the aid of the very same appendages.

DISCUSSION

Males and females in this collection, unlike those of *T. cancriformis* (Bosc) are roughly equal in number. Since males in this lot are smaller in size, they may not outnumber the females. However, Karande & Inamdar (loc. cit.) and Shanbhag & Inamdar (loc. cit.) have reported that females outnumber males in this species but Tiwari (1955) noted more and larger males. It may be inferred that *T. granarius* may show variability in the sex-ratio depending on season and locality.

In the present collection, the dorsal organ is not oval as described by Tiwari (1951) for *Triops (Apus) sudanicus* but is triangular and elevated. As Barnard (1931), while assessing the characters of taxonomic importance in *Triops* says, 'The essential differences lie not in the shape of the pellucid area so much as in the shape and position of the raised area as seen in profile.'

Exposed segments show a wide variation in number in this lot of specimens also, as in the descriptions by Karande & Inamdar (loc. cit.). The number of apodous segments is fairly constant in all individuals of any one sample described in the past, and in the present lot the number is smaller than what is described for this species by Tiwari (1955) and by Shanbhag & Inamdar (loc. cit.), but certainly fall within the wide range of variations assigned to this species by Longhurst (loc. cit.).

The present lot of *Triops* from the Palayamkottai region resembles more closely the descriptions of the single male collected and described as *Apus sudanicus* by Chacko (loc. cit.) and Tiwari (1951). They also agree with *Apus mavliensis* with regard to the exposed abdominal segments and the apodous segments but seem to differ to some extent from *Apus orientalis*. However, the range of all these variations mentioned in earlier descriptions, apparently come within the range of intraspecific variations known and established by Longhurst (loc. cit.), for *Triops*

granarius (Lucas). Therefore, there need be no further confusion regarding the specific status of *Triops* that occurs in south India.

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